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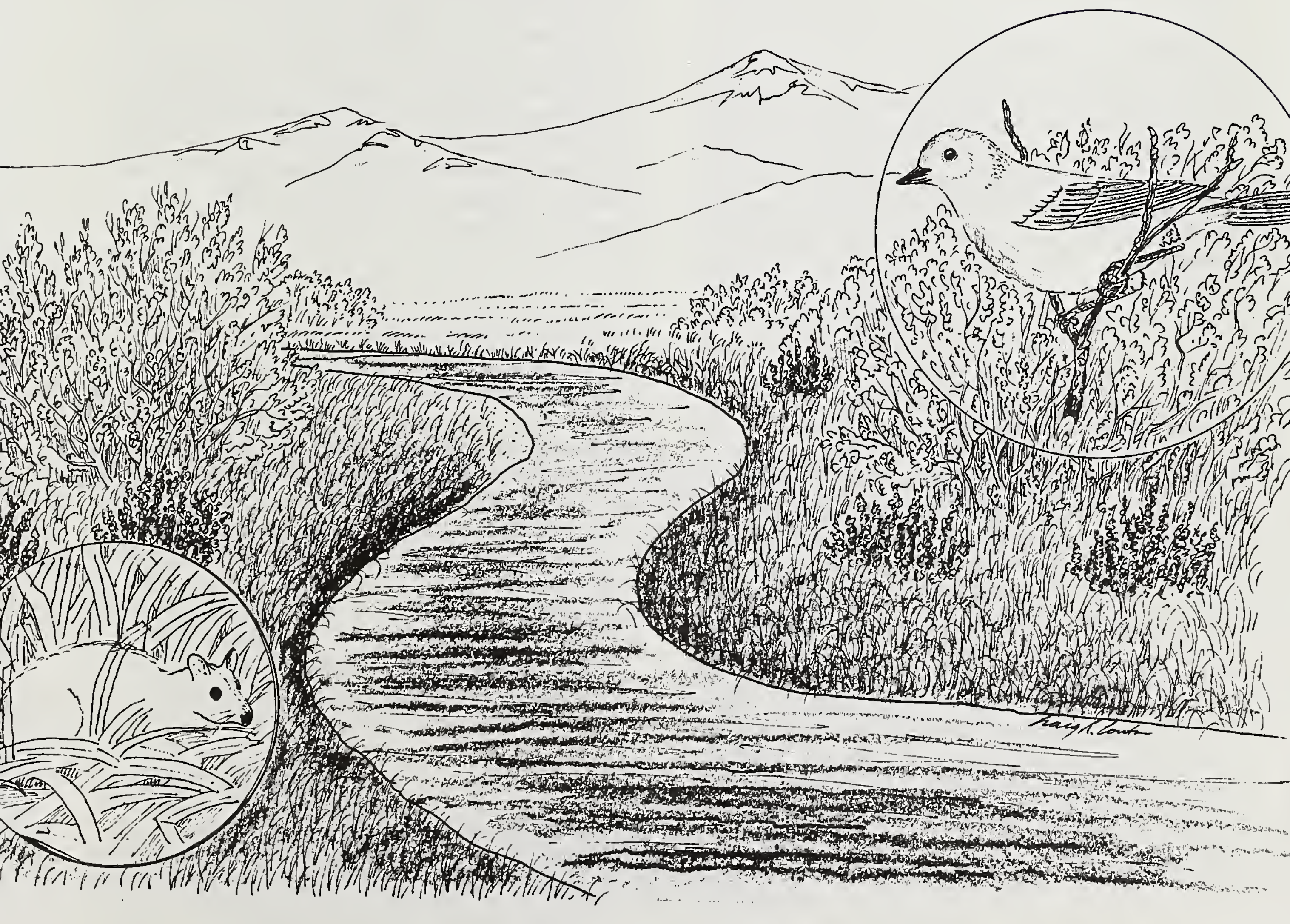
Vegetation, Nesting Bird, and Small Mammal Characteristics—Wet Creek, Idaho

**Warren P. Clary
Dean E. Medin**



THE AUTHORS

WARREN P. CLARY is Project Leader of the Intermountain Research Station's Riparian-Stream Ecology and Management research work unit at Boise, ID. He received a B.S. degree in agriculture from the University of Nebraska, an M.S. degree in range management, and a Ph.D. degree in botany (plant ecology) from Colorado State University. He joined the Forest Service in 1960 and conducted research on forested and nonforested rangelands in Arizona, Louisiana, and Utah. Most recently he has focused on riparian-livestock grazing issues in Idaho, Oregon, and Nevada.

DEAN E. MEDIN is research wildlife biologist (retired) with the Intermountain Research Station at the Forestry Sciences Laboratory in Boise, ID. He earned a B.S. degree in 1957 in forest management from Iowa State University, an M.S. degree in wildlife management in 1959 and a Ph.D. degree in range ecosystems in 1976 from Colorado State University. His research has included studies in mule deer ecology, big-game range improvement, mule deer population modeling, and nongame bird and small mammal ecology and habitat management.

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RESEARCH SUMMARY

Comparisons of terrestrial plant and small wildlife communities along two reaches of Wet Creek in south-central Idaho illustrated the effects of two seasons of light cattle grazing. These data may be used for comparisons with other riparian areas. The riparian area was divided into three plant communities based on visual aspect: Mesic Grass, Potentilla, and Salix. Most ground cover and herbaceous plant measures were similar among the three communities. Shrub cover was greatest in the Potentilla and Salix communities, while shrub height and biomass were greatest in the Salix community. The upland areas had lower values for all measured characteristics of herbaceous vegetation, similar amounts of shrub crown cover, but more bare ground and rock than the riparian areas. Few significant vegetation differences occurred between the light spring grazed reach and the light fall grazed reach.

Fourteen species of birds established nesting territories on the study reaches. No clear differences in breeding bird species composition, densities, biomasses, and diversities occurred between the spring- and fall-grazed riparian areas, although the numbers slightly favored the spring grazed area.

Nine species of small mammals were trapped. No meaningful difference occurred between the spring- and fall-use stream reaches. Small mammal density and species diversity were higher in the spring-use area, while standing crop biomass and species richness were higher in the fall-use area.

Intermountain Research Station
324 25th Street
Ogden, UT 84401

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INTRODUCTION

The biological importance of riparian areas is far out of proportion to their relative extent within the landscapes of the Western United States. Riparian plant communities are typically composed of distinctive species and, compared to adjacent communities, often have denser populations and larger individuals. This creates an oasis effect producing ecosystems rich in bird and mammal life (Szaro 1989).

Throughout the West these rich communities have been modified, some severely, by concentrated human or human-directed activities. The most ubiquitous disturbance is livestock grazing. Heavy livestock use of riparian areas can greatly reduce the shrub, particularly willow, populations due to browsing of twig tips, physical breakage of mature stems, and grazing of regeneration (Szaro 1989). Herbaceous sedge (*Carex* spp.) communities often are transformed to bluegrass (*Poa* spp.) communities (Platts and Nelson 1989), but grazing reduction does not always result in an immediate trend toward the original vegetation (Schulz and Leininger 1990).

The Bureau of Land Management (BLM), U.S. Department of the Interior, recently established four nationwide riparian-wetland goals. Two of these are to restore and maintain 75 percent of these areas by 1997, and to protect riparian-wetland areas and associated uplands through proper land management (USDI Bureau of Land Management 1991a). Ten years ahead of this national goal statement the BLM Big Butte Resource Area, Idaho Falls District, changed the grazing management of Wet Creek in east-central Idaho—an Idaho Stream Segment of Concern. The objectives of our study were to compare the biological communities on Wet Creek under two grazing regimes and to characterize Wet Creek for a comparison at a later date with several other sites of similar elevation, precipitation, and ecological zone.

STUDY AREAS

The study areas include 1.2 km of Wet Creek, a tributary of Little Lost River approximately 50 km northwest of Howe, ID. Annual precipitation averages about 240 mm. Elevation of the study sites varies from 2,000 to 2,040 m. The sites have an easterly aspect. The parent materials consist of limestone alluvium mixed with andesite from the Challis volcanics along with small amounts of quartzite. The soils exist on sorted alluvial deposits, mostly weathered gravel and boulders of limestone. The floodplain contains silt loam, loam, and sandy loam soils that are very deep and poorly drained (Bruhn 1990; Kotansky 1990).

In the riparian area the graminoids were typically dominated by Kentucky bluegrass (*Poa pratensis*), redtop (*Agrostis stolonifera*), Baltic rush (*Juncus balticus*), and sedges (*Carex rostrata, C. aquatilis, C. microptera, C. nebrascensis*). Several of the riparian forbs were western aster (*Aster occidentalis*), Rocky Mountain iris (*Iris missouriensis*), and longleaf phlox (*Phlox longifolia*). The most noticeable riparian woody plants were Booth willow (*Salix boothii*), Geyer willow (*S. geyeriana*), bush cinquefoil (*Potentilla fruticosa*), Woods rose (*Rosa woodsii*), currant (*Ribes* spp.), and water birch (*Betula occidentalis*). The predominant species in the uplands were bluebunch wheatgrass (*Agropyron spicatum*), crested wheatgrass (*A. cristatum*), sagebrushes (*Artemisia* spp.), and rabbitbrushes (*Chrysothamnus* spp.). See the appendix for a complete listing of plant species.

Prior to 1975 Wet Creek had been moderately to heavily grazed summer and fall by sheep and cattle. From 1975 to 1981 the riparian area was heavily used summer and fall by cattle. In 1981 fencing of 6.4 km of the stream created the Wet Creek Exclosure, of which 4 km, containing 73 ha, were made available for spring and fall trailing. Approximately 130 cattle spend 1 day trailing through at the end of June, and several days trailing through about October 1 for an estimated total use of 15 animal unit months (AUM's) (Gooch 1992; USDI Bureau of Land Management 1991b), or about 0.21 AUM per hectare. The Big Wet Pasture, upstream approximately 1.6 km, was changed from heavy use to a short period of grazing each spring. Annually, approximately 1,000 cattle are grazed for 2 days in mid-May and trailed through during 1 day about July 1. This use amounts to an estimated 82 AUM's on a grazeable area of 81 ha BLM and 194 ha of private holdings (Gooch 1992), or about 0.30 AUM per hectare.

METHODS

Two 9-ha grids, one in the exclosure subject to cattle trailing and one in the upstream spring grazing unit, were established and sampled in 1991. Grid locations were selected on the basis of similarities in topography and vegetation overstory. The grids, 600 by 150 m, were oriented lengthwise along Wet Creek. Both grids straddled the riparian area and included part of the adjacent uplands. Reference points were surveyed and marked with numbered stakes at 25-m intervals.

Vegetation and other habitat features of the two study reaches were sampled from July 19 to August 30. The grids were stratified into four plant communities based on differences and similarities in visual aspect: Mesic Grass, Potentilla, Salix, and Upland. Each reach of stream has its unique mosaic of communities. In our study reaches, the proportions for Mesic Grass, Potentilla, Salix, and Upland were, for the spring-use area, 8, 2, 10, and 80 percent, respectively, and for the fall-use area, 18, 3, 17, and 62 percent, respectively.

Ten sample locations were established within each plant community-grid combination, except that 20 locations were established within the Salix community to improve the sample for this important but spatially variable community. This provided a total sample size of 50 for each grid. Each plant community was given equal weight in comparisons between the two stream reaches because the specific proportions of plant communities are somewhat unusual to each reach independent of grazing effects.

A 50- by 50-cm (0.25-m^2) quadrat was located at each of the systematically positioned sample locations. Canopy cover (Daubenmire 1959) was ocularly estimated for the total of each plant life form (graminoid, forb, shrub) and recorded as the midpoint of one of eight percentage-cover classes (0-1, 1-5, 5-10, 10-25, 25-50, 50-75, 75-95, 95-100). Percentages of litter, rock, bare ground, and lichen-moss were similarly estimated. The vegetative height (excluding flower and seed-head heights) was measured for the graminoid, forb, and shrub nearest the center of each quadrat.

Biomass of graminoids, forbs, and small shrubs was determined by clipping vegetation from ground level upward within a vertical projection from the 0.25-m^2 quadrats. Clipped materials were bagged, ovendried, and weighed. A 3- by 3-m (9-m^2) plot concentric to each 0.25-m^2 quadrat was used to sample biomass of medium and large shrubs. Basal diameter, height, and species were recorded for each shrub stem rooted within the plot. For willow clumps, average stem diameter and average stem height were recorded instead of individual stems. Biomass of willows, birch, rose, and currant was estimated via equations based on a clipped subsample of an average of 10 to 15 plants using stem basal diameter, stem height, or both as predicting variables. Bush cinquefoil was represented by an average biomass per individual.

Unconfined soil compressive strength (index of bulk density) was measured in opposing corners of the 0.25-m^2 quadrats with a pocket penetrometer, averaged, and recorded. The corners were selected to best represent mineral soil, that is, soil surface not covered by heavy litter or duff, or rock. The readings were taken immediately upon selection of the sample location before plant sampling activities impacted the soil surface.

The study grids were censused for breeding birds using the spot-map method (International Bird Census Committee 1970). Twelve bird census visits were made to each grid from May 21 to June 20. The same observer (DEM) conducted the censuses on both grids. Most spot-mapping was done from sunrise to early afternoon when birds were most active. Census routes were varied by choosing different routes through the plot, with different starting and ending points. To ensure complete coverage, the plot was censused by walking within 25 m of all points on the grid. Observations and registrations extended well beyond grid boundaries. At the end of the sampling period, clusters of observations and coded activity patterns on species maps were circled to indicate areas of activity or approximate territories (International Bird Census Committee 1970). Fractional parts of boundary territories were included. Oelke (1981) summarized methodological difficulties and other special problems of the mapping method. We followed Hill (1973) for estimates of species diversity.

A 1.7-ha trapping grid was located in each of the study grids to estimate small mammal populations. Trapping grids were placed near the center of the 9-ha grids previously established. Each trapping grid measured 225 by 75 m and consisted of 40 trapping stations systematically spaced at 25-m intervals in 10 rows and four columns. The rectangular grids were positioned lengthwise along Wet Creek and straddled the stream channel. Two Museum Special mousetraps and one Victor rattrap were placed near each trapping station. Traps were baited with a mixture of peanut butter and rolled oats and examined daily for 5 consecutive days from August 1 to 5.

We used plant names from Cronquist and others (1977, 1984, 1989) for graminoids and certain broadleaf species. Otherwise, we followed Hitchcock and Cronquist (1973). The complete plant list for our study is in the appendix. Bird nomenclature is from the 1983 AOU Check-list (American Ornithologists' Union 1983). Scientific and common names of mammals follow Jones and others (1986).

RESULTS AND DISCUSSION

We look at the results in three categories: vegetation and soil; nesting birds; and small mammals.

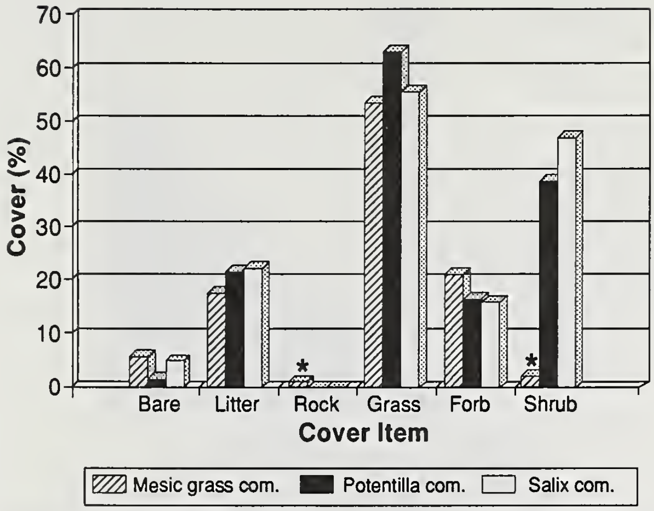

Figure 1—Cover characteristics of the riparian plant communities. * denotes a significant difference at $P < 0.10$.

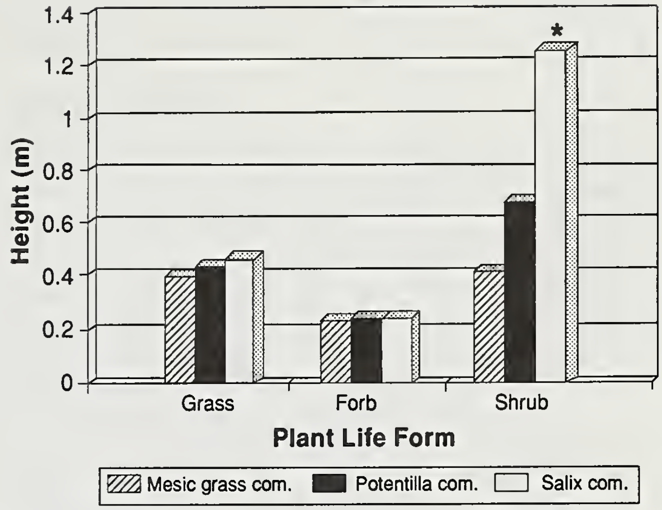

Figure 2—Height characteristics of the riparian plant communities. * denotes a significant difference at $P < 0.10$.

Vegetation and Soil

Riparian Complex—Division of the riparian complex into plant communities was based primarily on visual aspect. The three communities were Mesic Grass, Potentilla, and Salix. The apparent differences were generally reflected in the sample data, although a number of variables did not differ significantly. The three riparian plant communities had similar amounts of bare soil, litter, rock (a statistically significant but small difference), grass, and forb cover (fig. 1). A large difference in shrub cover existed wherein the Mesic Grass type had little compared to the other two types. Heights were similar for grasses and forbs among the riparian communities, but the shrub heights were significantly taller in the Salix community (fig. 2). No differences occurred among riparian plant communities in compressive soil strength. The mean was 1.73 kg/cm^2.

The amount of measured live biomass for grasses (and other graminoids) and forbs was similar among the three riparian communities (fig. 3). As expected, a large difference in shrub biomass occurred. The predominance of willows and an occasional water birch had a major impact on the Salix community characteristics. Booth willow was most prevalent while Geyer willow occurred irregularly (fig. 4). Woods rose and two species of currant, although quite apparent visually, did not contribute substantially to the biomass in any plant community (fig. 5). Bush cinquefoil was a predominant biomass contributor only in the Potentilla community.

Total biomass, both live and dead, differed greatly among the three communities. Figure 6 illustrates the combined values of the major components. The woody component is the primary source of the biomass and stature differences. Much less difference existed among the communities in the amount of foliage present. The only standing dead foliage was from previous-year graminoids. The previous-year forb and deciduous shrub foliage did not persist.

Upland—The upland areas (means shown in table 1) had significantly lower values than the riparian area for all measured characteristics of herbaceous vegetation ($P < 0.10$). However, dead shrub biomass, shrub crown cover, and shrub species number were not significantly different between riparian and upland areas. Live shrub biomass was higher in the riparian area, while percentages of bare ground and rock were higher in the upland areas.

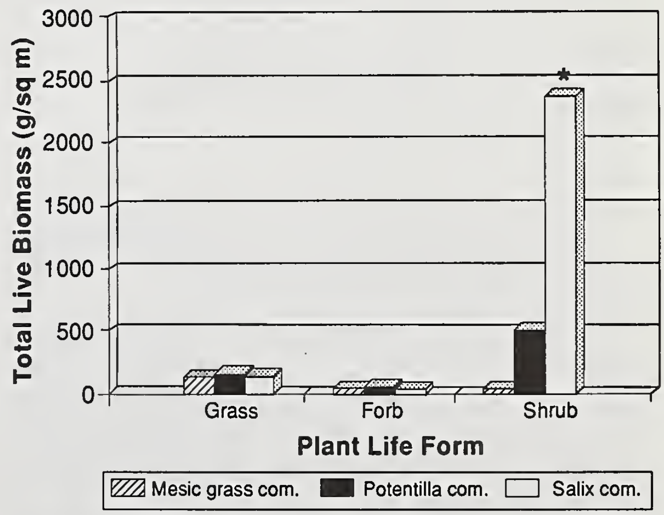

Figure 3—Live plant biomasses of the riparian plant communities. * denotes a significant difference at $P < 0.10$.

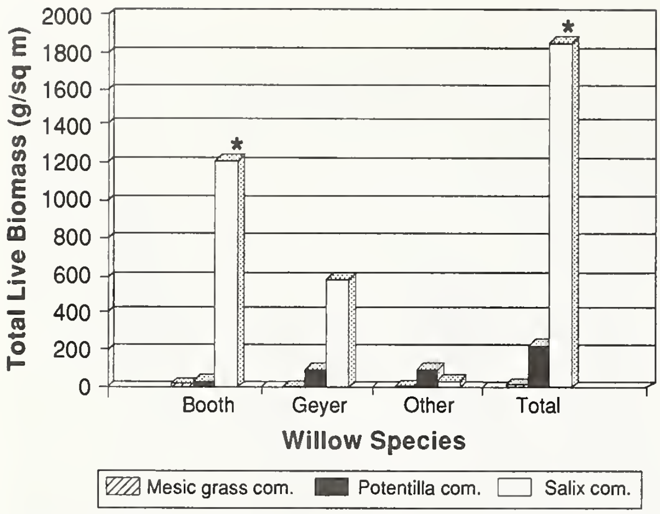

Figure 4—Live willow biomass of the riparian plant communities. * denotes a significant difference at $P < 0.10$.

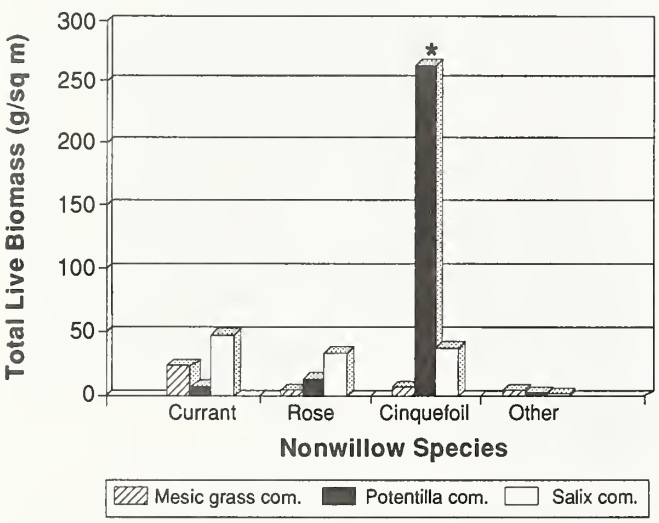

Figure 5—Live nonwillow shrub biomass of the riparian plant communities. * denotes a significant difference at $P < 0.10$.

Virtually no overlap occurred in plant species between the upland and riparian areas. We described the general plant compositions earlier.

Grazing-Induced Differences—Although available conditions did not allow a designed study of grazing impacts on Wet Creek, an opportunity was present to examine relative terrestrial biological differences between the lightly spring-grazed and the lightly fall-grazed areas.

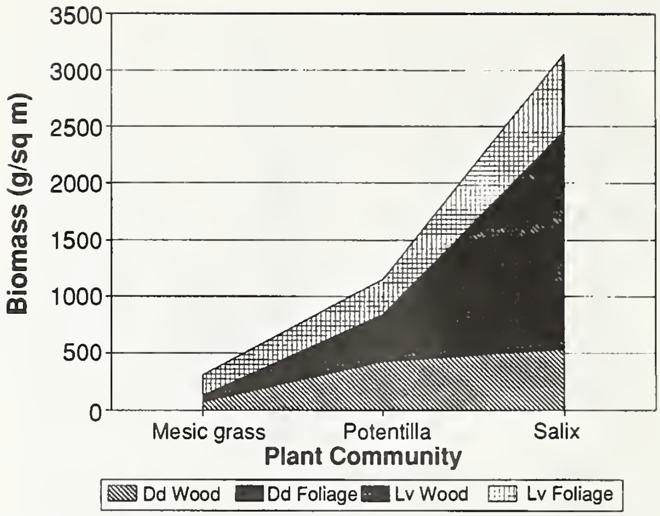

Figure 6—Biomass components of the riparian communities.

Table 1—Vegetation and other features of upland study plots, Wet Creek, ID, 1991

Item	**Light spring grazing**	**Light fall grazing**	***P*[1]**
Graminoid			
Biomass (g/m²)			
Live	34.0	26.4	0.69
Dead	9.2	8.0	.88
Canopy cover (%)	26.0	23.3	.76
Height (m)	.24	.24	.90
Species (No./0.25-m²)	1.8	1.7	.76
Forb			
Biomass (g/m²)			
Live	30.4	.8	.02
Dead	0	0	—
Canopy cover (%)	8.4	.8	.02
Height (m)	.11	.03	.13
Species (No./0.25-m²)	1.0	.3	.03
Shrub			
Biomass (g/m²)			
Live	193.6	566.4	.14
Dead	329.6	190.4	.39
Canopy cover (%)	18.6	35.2	.16
Height (m)	.42	.51	.42
Species (No./0.25-m²)	1.3	1.3	1.00
Other			
Bare ground (%)	38.0	43.8	.65
Litter (%)	20.2	18.6	.86
Rock (%)	6.2	3.2	.49
Soil compressive strength (kg/cm²)	1.78	1.15	.14

[1] *P* of less than 0.10 was considered significant.

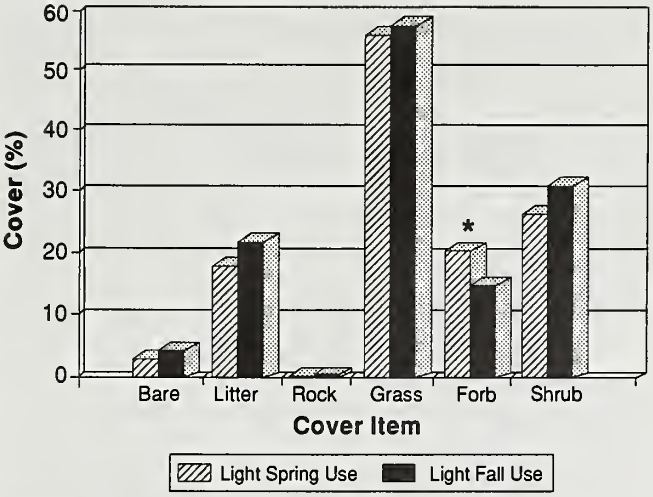

Figure 7—Riparian cover characteristics of the spring and fall use pastures. * denotes a significant difference at $P < 0.10$.

Little difference occurred in cover conditions or plant characteristics between the two grazing areas, except for several forb values. Greater forb cover (fig. 7 and table 1) and biomass (47.6 versus 24.8 g/m^2, riparian; table 1, upland) occurred in the spring grazing pasture on both the riparian and upland sites. Greater forb height occurred in the spring-grazed riparian area (fig. 8), while greater forb species richness occurred in the spring-grazed upland area (table 1). This forb response could be a reflection of season of use, although at these levels of forage utilization other factors may be more important. Some combination of historic grazing practices, subtle site differences, and the trend of reduced crown cover of sagebrush in the crested

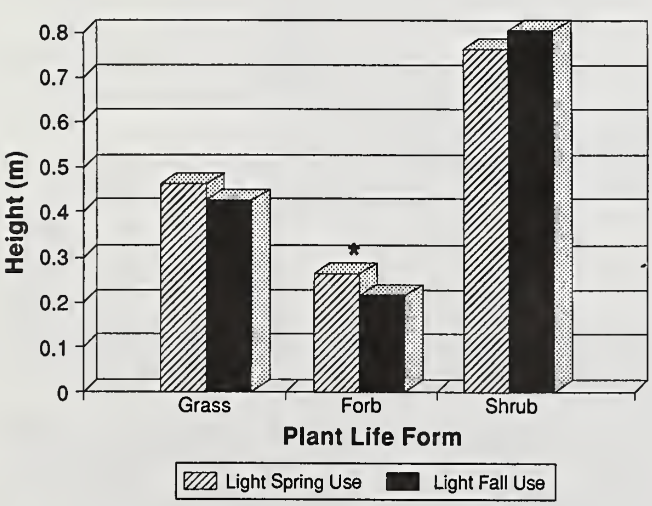

Figure 8—Riparian plant height characteristics of the spring and fall use pastures. * denotes a significant difference at $P < 0.10$.

wheatgrass seeding may be likely causes of the forb differences.

Nesting Birds

Fourteen species of birds established nesting territories on the study grids; 10 species bred on the light spring-grazed area and 12 species bred on the light fall-grazed area (table 2). Wide-ranging raptors, although commonly seen, were not included in the analysis. Many transient species were also excluded. An additional 27 species were observed. On the basis of our observations of habitat use, we classified birds into a riparian category (nine species) and an upland category (five species). The categories are not exclusive. In varying degrees, many of the species listed used both the riparian habitat and the adjacent upland habitat.

No clear differences were apparent between spring- and fall-use riparian areas concerning either the number of breeding bird species (eight versus seven) or breeding bird densities (84.4 versus 76.8), although the values were somewhat higher in the spring-grazed area (table 2). We attributed most of this to the presence of the song sparrow in the spring-use area, but the densities of the different species varied between the two areas. The presence of water birch intermingled with the willow species in the spring-use area may have influenced some nesting species, although the greater proportion of the Salix community in the spring-use area as opposed to the fall-use area was a more likely cause of the greater bird numbers (Medin and Clary 1990b). The biomass of riparian nesting birds and our estimate of bird species diversity (the reciprocal of Simpson's index) were both somewhat higher in the spring-use area than in the fall-use area (table 2).

The upland bird communities were greatly different in number of species and in population densities (table 2). Two species with a combined population density of 2.2 pairs per 40 ha occurred on the spring-use area, while five species with a combined density of 31.5 pairs per 40 ha occurred on the fall-use area. Similarly, the biomass comparisons and the Simpson's indices strongly favored the fall-use area where the perennial grasses were predominantly native and the shrub cover was heavier. Because little measurable use occurred on the upland portions of the study grids, current livestock grazing probably did not affect nesting bird populations. The most apparent environmental difference between the two upland areas is the presence of crested wheatgrass and the nonsignificant trend of reduced shrub cover and biomass in the spring-use area (table 1). Conversion of sagebrush stands to stands of crested wheatgrass can strongly reduce nesting bird populations (Reynolds and Trost 1980).

Table 2—Density (pairs per 40 ha), diversity, and other attributes of breeding bird populations on lightly grazed study plots, Wet Creek, ID, 1991

Species	Foraging guild[1]	Nesting guild[2]	Density: Light spring grazing	Density: Light fall grazing
Upland				
Black-billed magpie (*Pica pica*)	GGI	BTN	+[3]	1.3
Mountain bluebird (*Sialia currucoides*)	GGI	SCN	+	3.1
Sage thrasher (*Oreoscoptes montanus*)	GGI	GBN	+	1.8
Brewer's sparrow (*Spizella breweri*)	GGI	BTN	0.4	14.2
Vesper sparrow (*Pooecetes gramineus*)	GFO	GRN	1.8	11.1
Riparian				
Spotted sandpiper (*Actitis macularia*)	SGI	GRN	6.2	4.0
Empidonax flycatcher[4] (*Empidonax* spp.)	ASI	BTN	18.7	12.4
American robin (*Turdus migratorius*)	GGV	BTN	15.6	12.9
Warbling vireo (*Vireo gilvus*)	CGI	BTN	.9	+
Yellow warbler (*Dendroica petechia*)	CGI	BTN	17.3	27.6
Chipping sparrow (*Spizella passerina*)	GFO	BTN	6.2	4.4
Song sparrow (*Melospiza melodia*)	CFO	GRN	7.1	+
White-crowned sparrow (*Zonotrichia leucophrys*)	GFO	BTN	12.4	13.3
Brewer's blackbird (*Euphagus cyanocephalus*)	GFO	GBN	+	2.2
Total pairs/40 ha			86.6	108.3
Riparian			84.4	76.8
Upland			2.2	31.5
Total individuals/km²			433	542
Riparian			422	384
Upland			11	158
Biomass[5] (g/ha)			122	148
Riparian			120	106
Upland			2	42
Species richness (*n*)			10	12
Riparian			8	7
Upland			2	5
Species diversity[6] ($1/p_i^2$)			6.38	7.17
Riparian			6.07	4.55
Upland			1.47	2.93

[1]After DeGraaf and others (1985). GGI = ground gleaning insectivore, GFO = ground foraging omnivore, SGI = shoreline gleaning insectivore, ASI = air sallying insectivore, GGV = ground gleaning vermivore, CGI = canopy gleaning insectivore, CFO = canopy foraging omnivore.
[2]After Harrison (1979). BTN = bush and small tree nester, SCN = secondary cavity nester, GBN = ground and bush nester, GRN = ground nester.
[3]+ indicates bird observed infrequently.
[4]Specific identification of the *Empidonax* flycatcher was not confirmed.
[5]Species weights from Dunning (1984).
[6]After Hill (1973). Here, p_i is the proportional abundance of the *n* species in a sample.

The riparian area drew many bird foraging guilds. While the surrounding upland supported only birds of the ground foraging-gleaning guild, the riparian area also had birds of the shoreline gleaning, air sallying, and canopy foraging-gleaning guilds (table 3). This is a striking illustration of the increase in biodiversity that a riparian area can bring to the landscape. The differences in nesting guilds between riparian and upland birds are less apparent, although bush nesters predominate in the riparian area and ground nesters predominate in the adjacent upland (table 3).

Only the song sparrow and the black-billed magpie were resident nesting birds. The remaining species (eight riparian, four upland) were migrants. Therefore, because the riparian and the upland migrants were different species, the presence of the riparian area tripled the number of nesting migrant bird species in the study area. Similarly, Knopf (1985) found in a comparison of riparian and upland sites that 82 percent of the breeding birds were in riparian sites. We conclude that these small riparian areas are most important in providing nesting habitats for migrant birds in the mountainous West (Saab and Groves 1992).

Previous reports discuss the general habitat affinities of most of these nesting birds (Medin 1990, 1992; Medin and Clary 1990a, b, 1991a).

Small Mammals

Nine species of small mammals were trapped during the study period (table 4). Deer mice accounted for 56 to 66 percent of the individual animals caught. Montane voles and western jumping mice were the next most abundant species. The naive density of the total small mammal population was highest in the spring-use area (73.4 versus 66.3 individuals per ha), but the total standing crop biomass was highest in the fall-use area (1,275 versus 1,328 g per ha). Likewise, no clear difference between the areas occurred in other measures. Species richness was slightly greater in the fall-use area, but the index of species diversity was slightly greater in the spring-use area (table 4). Reynolds and Trost (1980) found that small mammal densities were reduced following an almost total replacement of sagebrush with crested wheatgrass. Substantial sagebrush cover was retained in the spring-use upland area on Wet Creek, so sufficient vegetation diversity and cover apparently were present to maintain rather similar small mammal populations compared to the fall-use area that had no crested wheatgrass seeding.

Previous reports discuss the general habitat affinities of many of these small mammal species (Medin and Clary 1989, 1990a, 1991b).

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Table 3—Guild density (pairs per 40 ha) of breeding birds on lightly grazed study plots, Wet Creek, ID, 1991

	Light spring grazing				Light fall grazing			
	Riparian		Upland		Riparian		Upland	
Guild	Density	Percent	Density	Percent	Density	Percent	Density	Percent
Foraging								
Shoreline gleaning	6.2	7.3	—	—	4.0	5.2	—	—
Ground foraging-gleaning	34.2	40.5	2.2	100.0	32.8	42.7	31.5	100.0
Air sallying	18.7	22.2	—	—	12.4	16.2	—	—
Canopy foraging-gleaning	25.3	30.0	—	—	27.6	35.9	—	—
Total	84.4	100.0	2.2	100.0	76.8	100.0	31.5	100.0
Nesting								
Ground nesting	13.3	15.8	1.8	81.8	4.0	5.2	11.1	35.2
Ground-bush nesting	—	—	—	—	2.2	2.9	1.8	5.7
Bush nesting	71.1	84.2	.4	18.2	70.6	91.9	15.5	49.2
Cavity nesting	—	—	—	—	—	—	3.1	9.9
Total	84.4	100.0	2.2	100.0	76.8	100.0	31.5	100.0

Table 4—Relative abundance, naive density, and other attributes of small mammal populations on lightly grazed study plots, Wet Creek, ID, 1991

Species	Foraging guild[1]	Relative abundance (*n*/100 trap nights)		Naive density[2] (*n*/ha)	
		Light spring grazing	Light fall grazing	Light spring grazing	Light fall grazing
Vagrant shrew (*Sorex vagrans*)	INS	0.2	0.2	0.6	0.6
Water shrew (*Sorex palustris*)	INS	.5	.2	1.8	.6
Least chipmunk (*Tamius minimus*)	OMN	0	2.2	0	7.7
Townsend's ground squirrel (*Spermophilus townsendii*)	OMN	0	.2	0	.6
Deer mouse (*Peromyscus maniculatus*)	OMN	11.7	12.3	41.4	43.8
Montane vole (*Microtus montanus*)	HER	3.0	2.3	10.6	8.3
Water vole (*Microtus richardsoni*)	HER	.3	0	1.2	0
Sagebrush vole (*Lemmiscus curtatus*)	HER	.2	.2	.6	.6
Western jumping mouse (*Zapus princeps*)	OMN	4.8	1.2	17.2	4.1
Total naive density (*n*/ha)				73.4	66.3
Total standing crop biomass (g/ha)				1,275	1,328
Species richness (*n*)				7	8
Species diversity[3] ($1/p_i^2$)				2.53	2.13

[1]After Martin and others (1951). INS = insectivore, OMN = omnivore, HER = herbivore.
[2]After Wilson and Anderson (1985). Effective trapping area and grid size are assumed to be equal.
[3]After Hill (1973). Here p_i is the proportional abundance of the *n* species in a sample.

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APPENDIX: PLANT SPECIES IDENTIFIED ON THE WET CREEK STUDY AREA

Graminoids

Cyperaceae
Carex aquatilis Wahl.
Carex lanuginosa Michx.
Carex microptera Mack.
Carex nebrascensis Dewey
Carex rostrata Stokes

Juncaceae
Juncus ?nevadensis Wats.
Juncus balticus Willd.
Juncus ensifolius Wikstr.
Luzula hitchcockii Hamet-Ahti

Poaceae
Agropyron cristatum (L.) Gaertn.
Agropyron dasystachyum (Hook.) Scribn.
Agropyron spicatum (Pursh) Scribn. & Smith
Agrostis stolonifera L.
Bromus tectorum L.
Deschampsia cespitosa (L.) Beauv.
Elymus cinereus Scribn. & Merr. var. *cinereus*
Oryzopsis hymenoides (R.&S.) Ricker
Phleum pratense L.
Poa pratensis L.
Poa sandbergii Vasey
Sitanion hystrix (Nutt.) Smith
var. *brevifolium* (Smith) Hitchc.

Forbs

Asteraceae
Achillea millefolium L. ssp. *lanulosa* (Nutt.) Piper
Antennaria microphylla Rydb.
Aster campestris Nutt.
Aster occidentalis (Nutt.) T.&G.
Chrysothamnus viscidiflorus (Hook.) Nutt.
Crepis runcinata (James) T.&G.
Erigeron pumilus Nutt.
Haplopappus acaulis (Nutt.) Gray
Haplopappus uniflorus (Hook.) T.&G.
Machaeranthera ?canescens (Pursh) Gray
Solidago canadensis L. var. *salebrosa* (Piper) Jones
Townsendia florifer (Hook.) Gray

Boraginaceae
Mertensiana oblongifolia (Nutt.) G. Don

Brassicaceae
Schoenocrambe linifolia (Nutt.) Greene

Caryophyllaceae
Arenaria kingii (Wats.) M. E. Jones

Equisetaceae
Equisetum arvense L.
Equisetum laevigatum A. Br.

Fabaceae
Astragalus ?purshii Dougl. var. *consinnus* Barneby
Astragalus canadensis L.
Astragalus diversifolius A. Gray
Astragalus miser Dougl. var. *praeteritus* Barneby
Astragalus tenellus Pursh
Lupinus argenteus Pursh
var. *utahensis* (S. Wats.) Barneby
Oxytropis viscida Nutt.
Trifolium longipes Nutt.

Gentianaceae
Gentiana affinis Griseb.

Iridaceae
Iris missouriensis Nutt.
Sisyrinchium idahoense E. P. Bicknell

Juncaginaceae
Triglochin palustris L.

Lamiaceae
Mentha arvensis L.

Liliaceae
Allium textile Nels. & Macbr.
Zigadenus elegans Pursh

Onagraceae
Epilobium glandulosum Lehm.

Polemoniaceae
Phlox longifolia Nutt. var. *longifolia*

Polygonaceae
Eriogonum ovalifolium Nutt. var. *ovalifolium*

Primulaceae
Dodecatheon pulchellum (Raf.) Merrill
var. *pulchellum*

Ranunculaceae
Delphinium nuttallianum Pritz.
var. *nuttallianum*
Ranunculus cymbalaria Pursh

Saxifragaceae
Parnassia palustris L.
var. *montanensis* (F.&R.) Hitchc.

Scrophulariaceae
Castilleja angustifolia (Nutt.) G. Don
var. *angustifolia*
Castilleja miniata Douglas
Mimulus guttatus DC.
Penstemon pumilus Nutt.

Valarianaceae
Valeriana edulis Nutt. var. *edulis*

Violaceae
Viola adunca J. E. Smith

Trees and Shrubs

Asteraceae

Artemisia arbuscula Nutt.
Artemisia frigida Willd.
Artemisia ludoviciana Nutt. var. *latiloba* Nutt.
Artemisia tridentata Nutt. ssp. *tridentata*
Chrysothamnus nauseosus (Pall.) Britt.
Chrysothamnus viscidiflorus (Hook.) Nutt. var. *stenophyllus* (Gray) Hall
Chrysothamnus viscidiflorus (Hook.) Nutt.
Chrysothamnus viscidiflorus (Hook.) Nutt. var. *lanceolatus* (Nutt.) Greene
Sphaeromeria argentea Nutt.
Tetradymia canescens DC.

Betulaceae

Betula occidentalis Hook.

Chenopodiaceae

Atriplex nuttallii Wats. var. *falcata* Jones
Eurotia lanata (Pursh) Moq.

Grossulariaceae

Ribes aureum Pursh
Ribes setosum Lindl.

Polemoniaceae

Leptodactylon pungens (Torr.) Nutt.

Polygonaceae

Eriogonum microthecum Nutt. var. *laxiflorum* Hook.

Rosaceae

Potentilla fruticosa L.
Potentilla gracilis Dougl.
Rosa woodsii Lindl.

Salicaceae

Salix bebbiana Sarg.
Salix boothii Dorn
Salix exigua Nutt. var. *exigua*
Salix geyeriana Anderss.

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Most ground cover and herbaceous plant measures were similar among the riparian plant communities. Shrub cover was greatest in the Potentilla- and Salix-dominated communities while shrub height and biomass were greatest in the Salix community. Fourteen species of birds established nesting territories on the study reaches. Four bird foraging guilds were represented by the riparian nesters, while only one foraging guild was represented by the upland nesters. Nine species of small mammals were trapped on the study sites.

KEYWORDS: riparian community, mesic grass, *Potentilla*, *Salix*, foraging guild, nesting guild, riparian grazing

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The Intermountain Research Station provides scientific knowledge and technology to improve management, protection, and use of the forests and rangelands of the Intermountain West. Research is designed to meet the needs of National Forest managers, Federal and State agencies, industry, academic institutions, public and private organizations, and individuals. Results of research are made available through publications, symposia, workshops, training sessions, and personal contacts.

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